

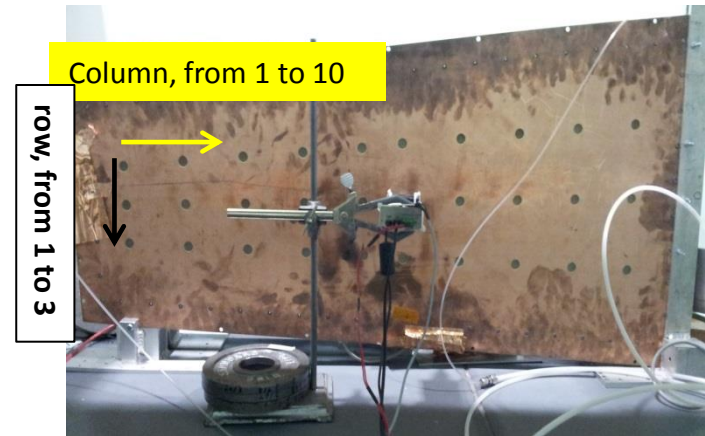
Gain uniformity measurement of the 1-m GEM detector

Aiwu Zhang

07/20/2015

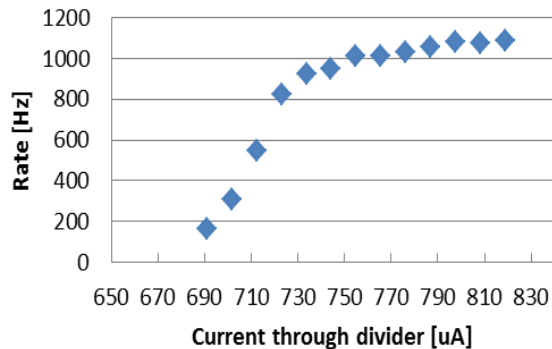
A problem of previous rate measurement

- Only one Panasonic connector was connected to pico-Ameter on the r/o board, ie., only 128 strips are grounded through the pico-Ameter.
- When measuring different positions, the connector was not moved correspondingly;
- When move source farther, the beam spot will cover some strips that are not grounded.
- For those strips that are not terminated, the induction field is not built properly! So bad signals were taken. (looks like in this case the detector works as a 2-layer, with the 3rd foil as a high resistive r/o board.)
- This problem does not affect the previous gain measurements because for those measurements the beam spot was well in the grounded-strip region.



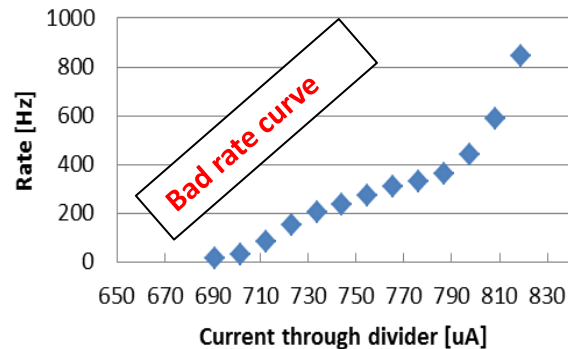
Beam spot: 6 mm

X ray 30 kV / 5 uA, 1 mm collimator
(5 cm distance)



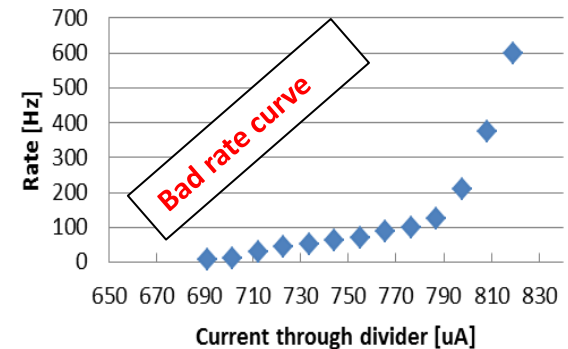
Beam spot: 11 mm

X ray 30 kV / 5 uA, 1 mm collimator
(10 cm distance)

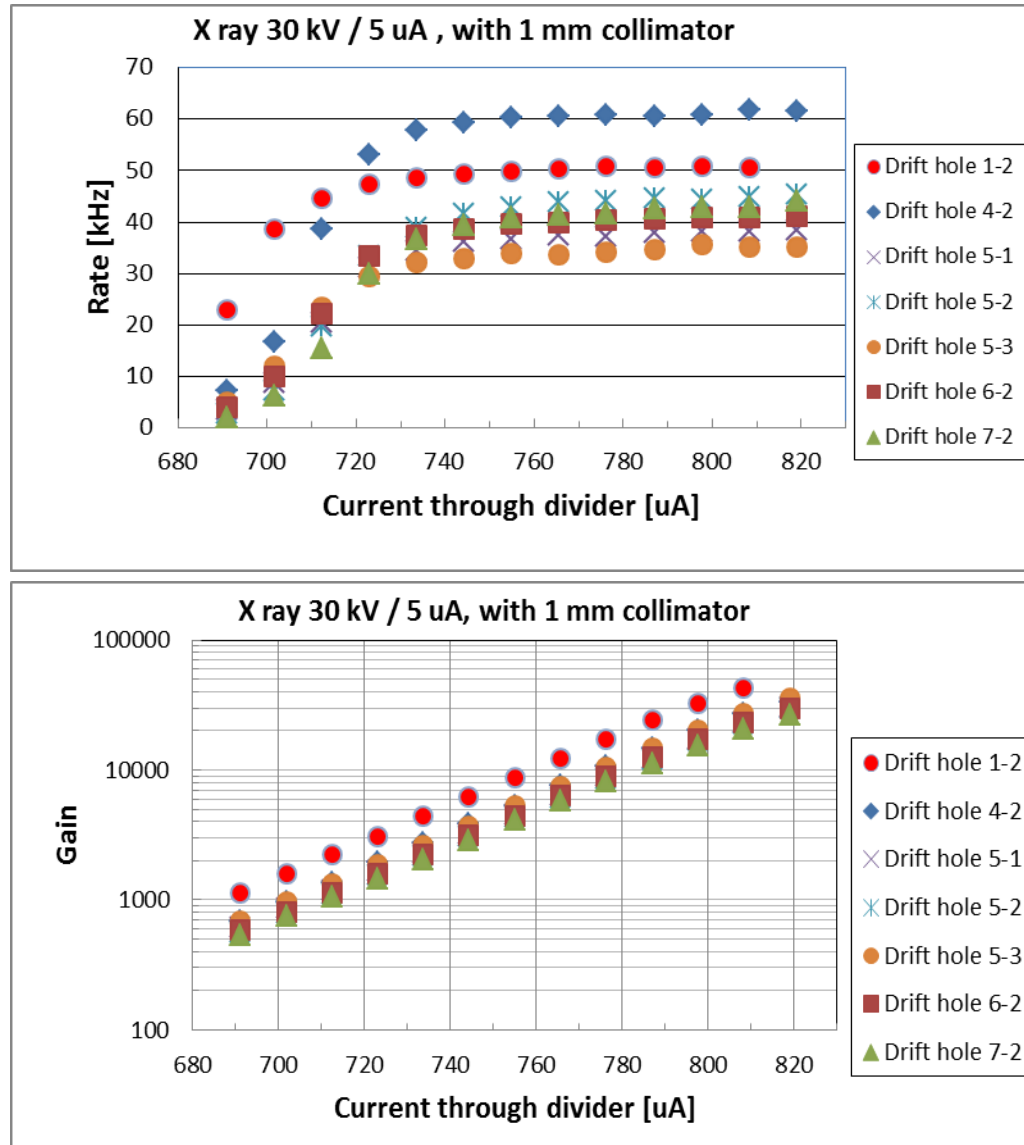


Beam spot: 16 mm

X ray 30 kV / 5 uA, 1 mm collimator
(15 cm distance)

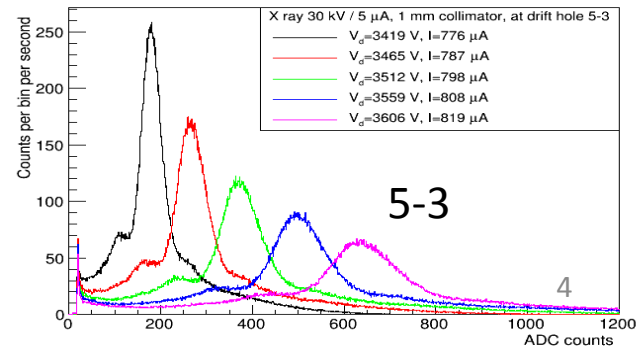
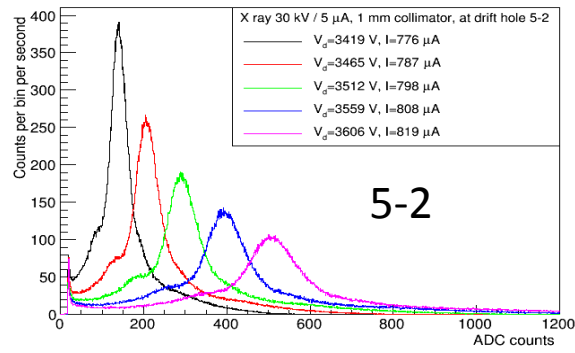
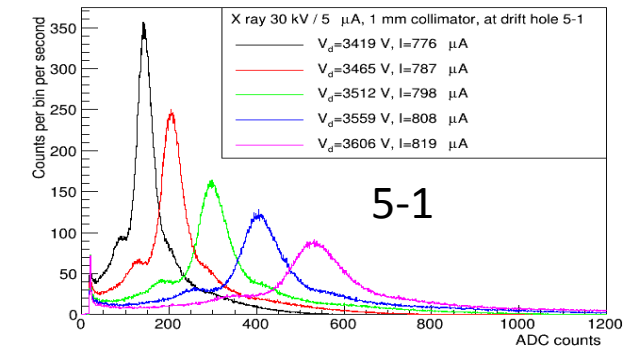
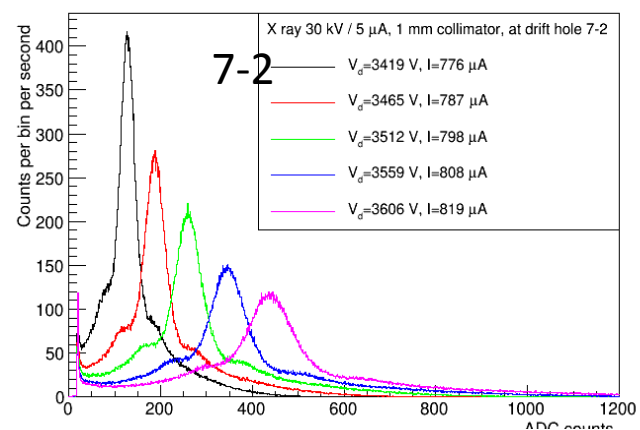
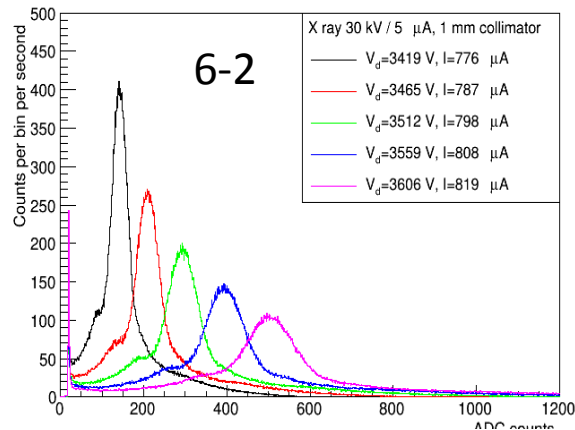
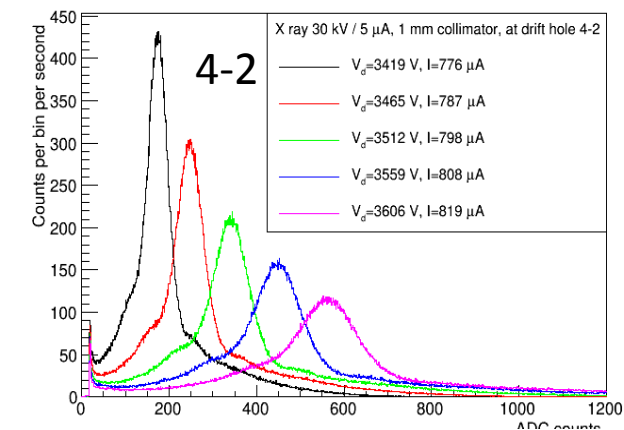
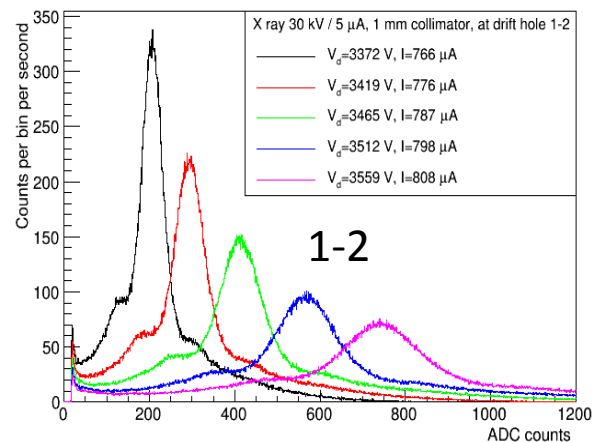


Gain and rate update for different positions



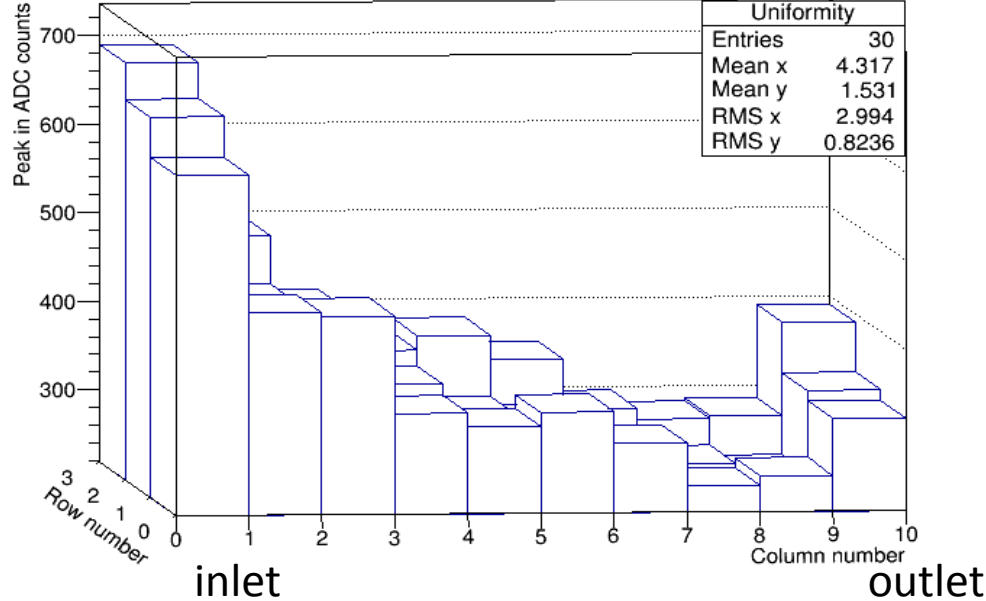
- After fixing the problem, good rate plateau can be measured everywhere.
- Threshold 60 mV for rate measurements. / X ray very close to detector (~0 cm).

Spectra for X rays at different positions at higher tested voltages on GEM

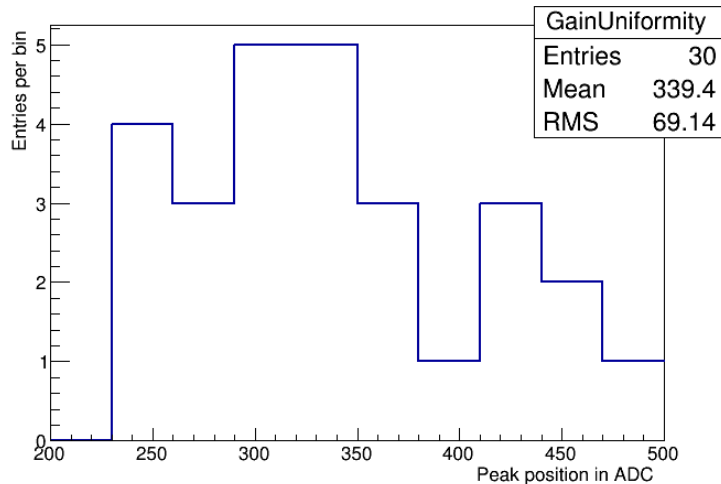
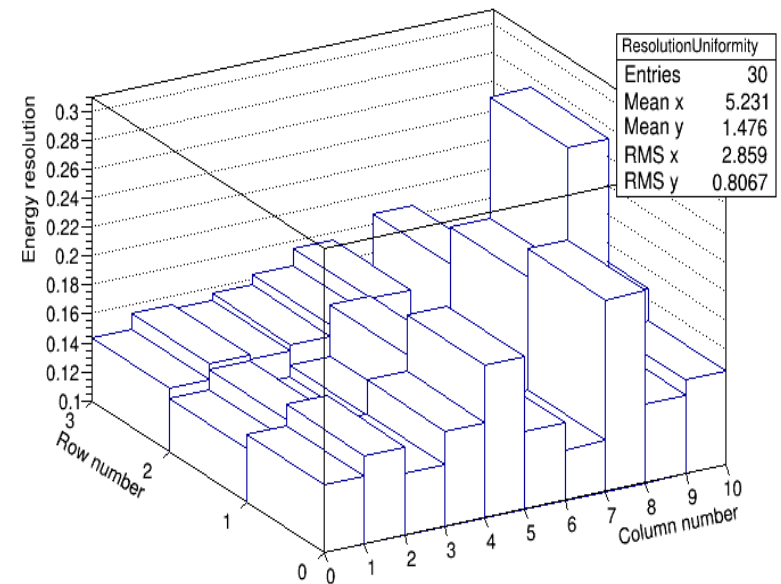


Uniformity measurements (X ray 30kV/5uA, 1 mm collimator, I=798uA,V_d=3512V)

Peak positions on the X ray spectra



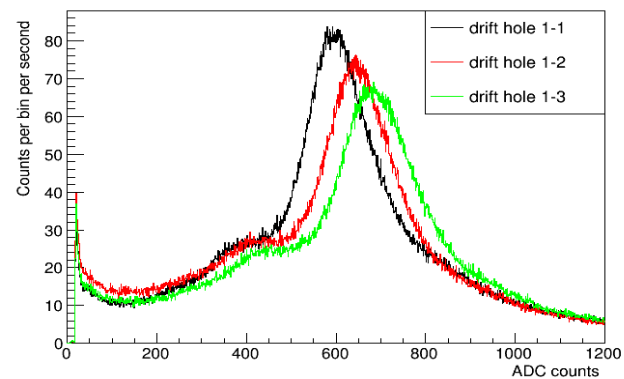
Energy resolution (sigma/peak)



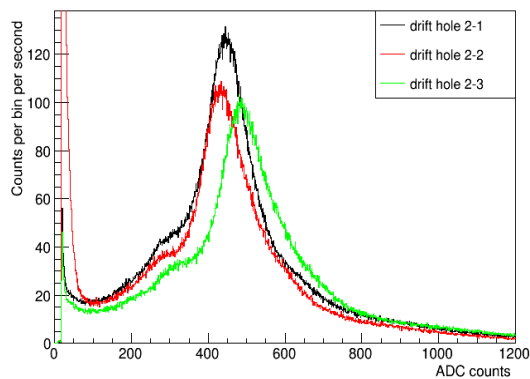
- A measure of the non-uniformity (column 1 data not included on the histogram):
 $\text{RMS}/\text{Mean} = 69.14/339.4 = 20.4\%$, in agreement with our beam test.
- We observe the gain decreases from column 1 to 9, especially at column 1 it is about 2 times higher. The reason could be: (1) we have gas leak at the outlet which is close to column 10, so at outlet positions O2 contamination reduces the gain; (2) gas flow rate at inlet is higher which potentially gives higher gain.

Spectra at different positions for uniformity measurement

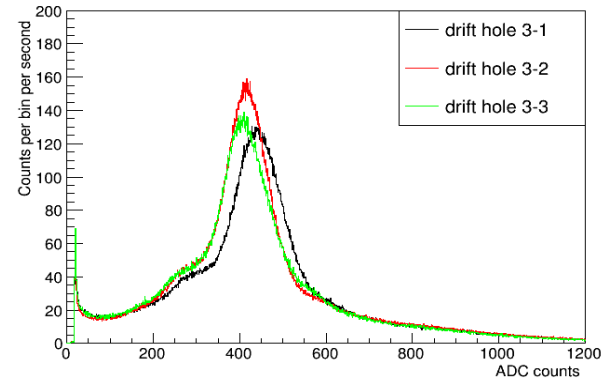
X ray 30 kV / 5 μ A, 1 mm collimator, at $V_d=3512$ V, $I=798$ μ A



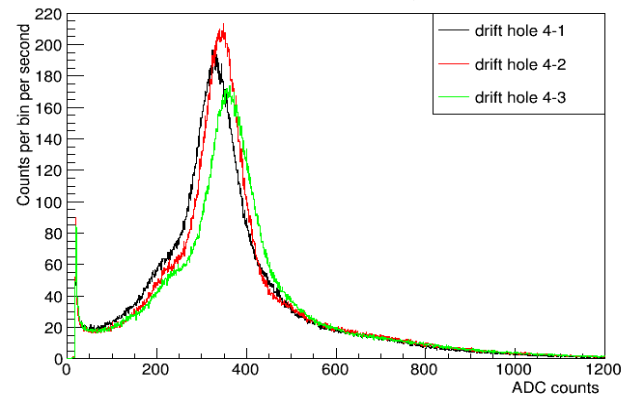
X ray 30 kV / 5 μ A, 1 mm collimator, at $V_d=3512$ V, $I=798$ μ A



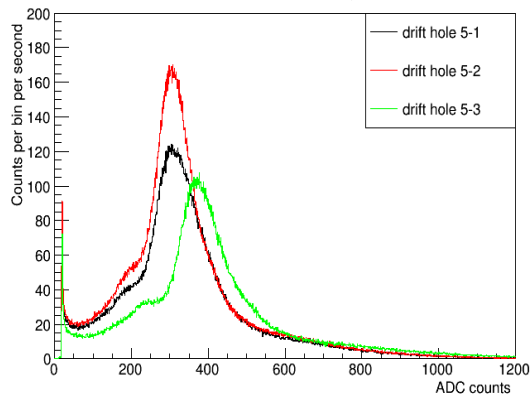
X ray 30 kV / 5 μ A, 1 mm collimator, at $V_d=3512$ V, $I=798$ μ A



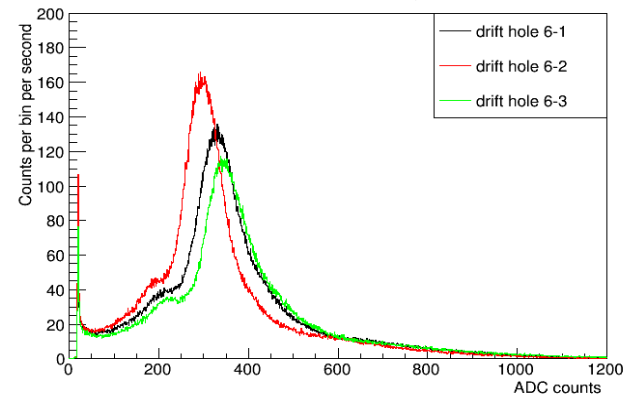
X ray 30 kV / 5 μ A, 1 mm collimator, at $V_d=3512$ V, $I=798$ μ A



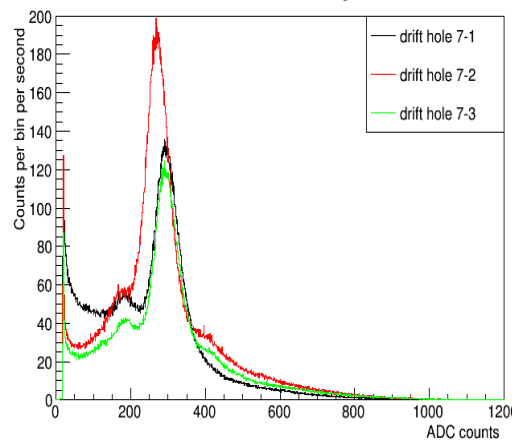
X ray 30 kV / 5 μ A, 1 mm collimator, at $V_d=3512$ V, $I=798$ μ A



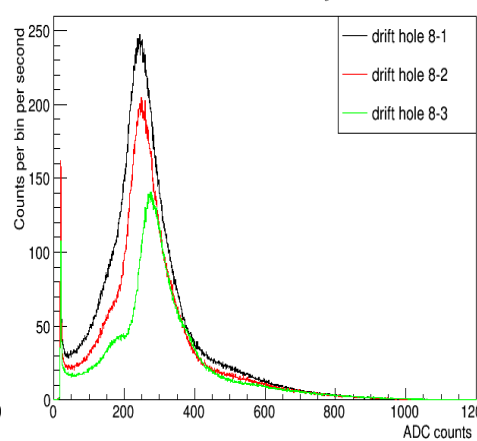
X ray 30 kV / 5 μ A, 1 mm collimator, at $V_d=3512$ V, $I=798$ μ A



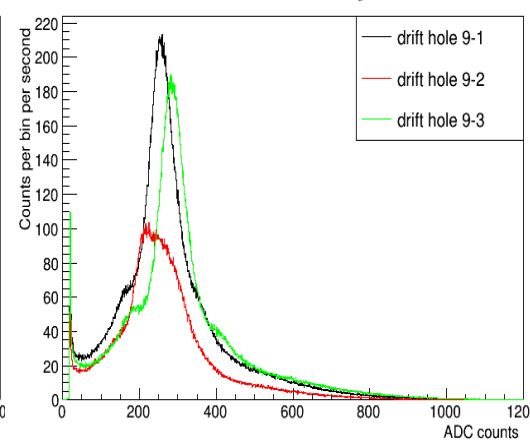
X ray 30 kV / 5 μ A, 1 mm collimator, at $V_d=3512$ V, $I=798$ μ A



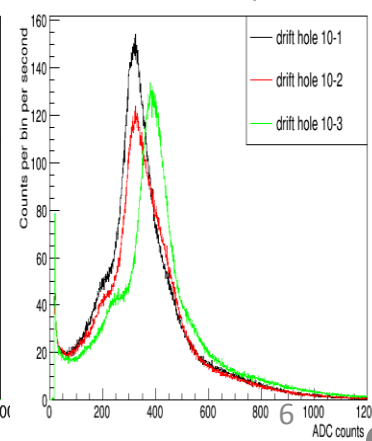
X ray 30 kV / 5 μ A, 1 mm collimator, at $V_d=3512$ V, $I=798$ μ A



X ray 30 kV / 5 μ A, 1 mm collimator, at $V_d=3512$ V, $I=798$ μ A

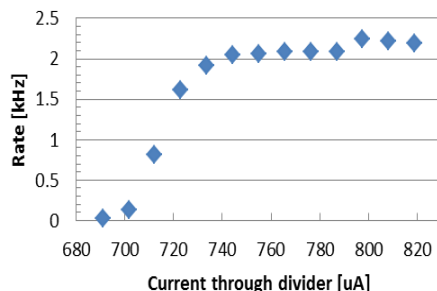


X ray 30 kV / 5 μ A, 1 mm collimator, at $V_d=3512$ V, $I=798$ μ A



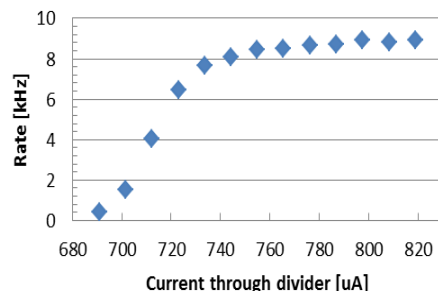
Rate measurement with larger beam spot (larger distance)

X ray 10 kV / 100 μ A, no collimator
(151 cm distance, beam spot 87 cm)



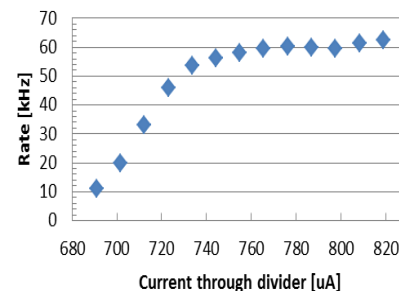
X ray 10 kV / 100 μ A, no collimator, at 151 cm distance

X ray 20 kV / 5 μ A, no collimator
(151 cm distance, beam spot 87 cm)



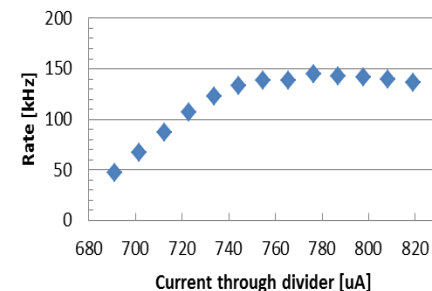
X ray 20 kV / 5 μ A, no collimator, at 151 cm distance

X ray 30 kV / 5 μ A, no collimator
(151 cm distance, beam spot 87 cm)

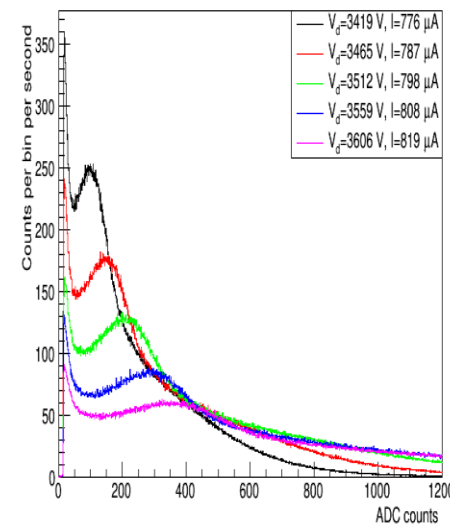
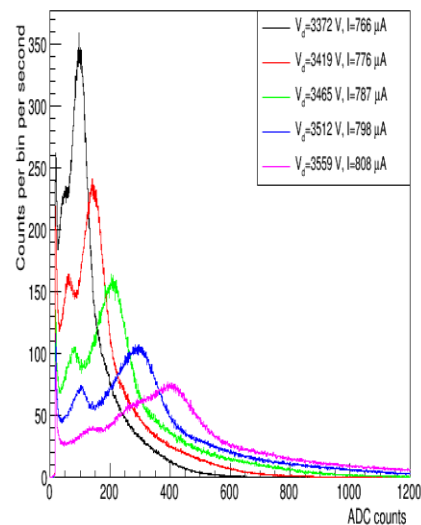
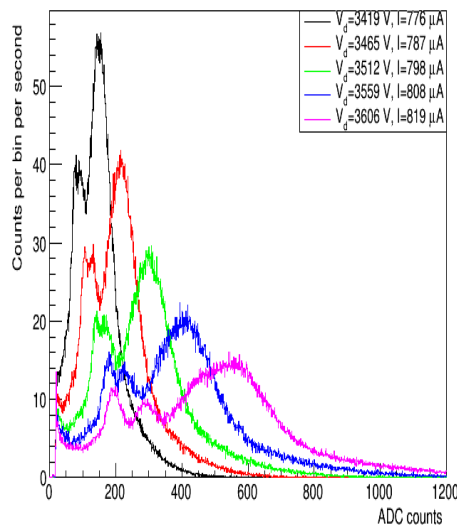
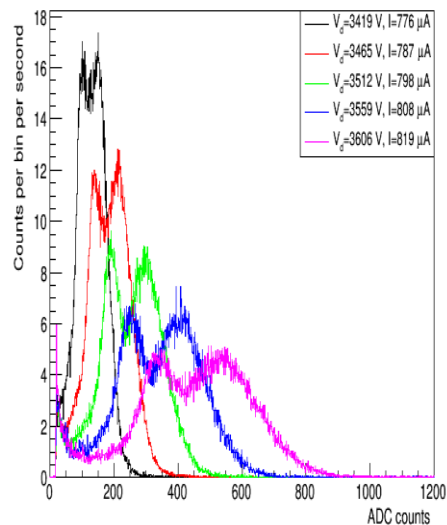


X ray 30 kV / 5 μ A, no collimator, at 151 cm distance

X ray 40 kV / 5 μ A, no collimator
(151 cm distance, beam spot 87 cm)



X ray 40 kV / 5 μ A, no collimator, at 151 cm distance

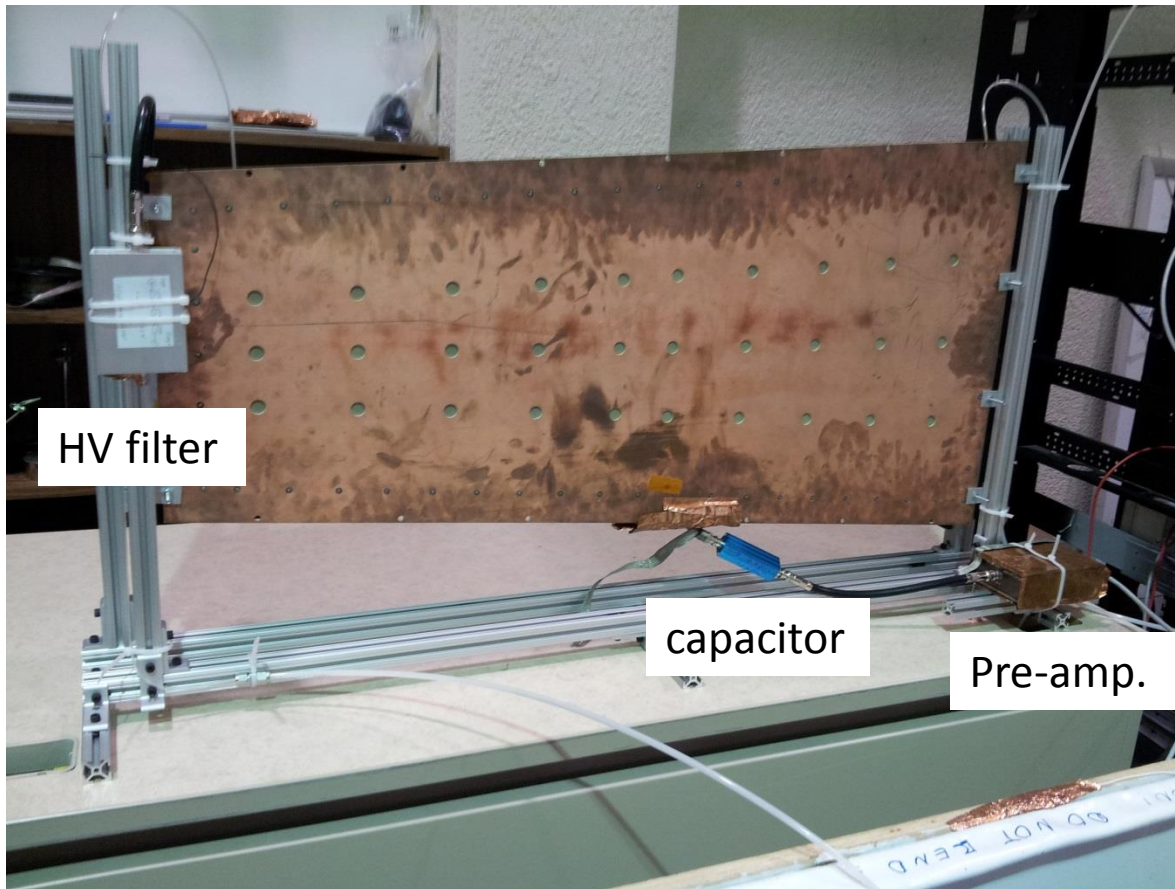


Connect all strips to the r/o ground,
Source is at **~151 cm distance**, w/o collimator.
Good rate plateau can be still measured, for different X ray gun voltages.

Summary

- We have now better understanding to this large-area detector.
- Its gain uniformity tends out no bad, and is in agreement with our beam test measured from strips with APVs.

-> Next: plug SRS in and commission it so that we can study every single strip.



Thanks!